



Transportation of Intermediate-level Radioactive Liquid Waste and Spent Fuel

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This article includes two parts

1. The transportation of intermediate-level radioactive liquid waste

- Introduction of the operation of nuclear facilities related to R & D in CIAE; The nuclear facilities which produce intermediate-level liquid waste in future are classified as 4 kinds: in-service nuclear facilities; being built nuclear facilities; planning nuclear facilities; decommissioning nuclear facilities. The volume of intermediate-level radioactive liquid waste: About 23 m³ per year for normal operation; Maximum volume per year is not more than 35.5 m³ for the decommissioned phase of CIAE nuclear facilities. Radionuclides of intermediate-level liquid waste mainly include fission products, activation products and corrosion products, etc. Range of concentration is $4.42 \times 10^6 \sim 4 \times 10^9$ Bq/L, main nuclides are ¹³⁷Cs, ⁶⁰Co, ⁹⁰Sr and some other little nuclides.
- Original transportation system of radioactive liquid waste: Intermediate-level radioactive liquid waste which comes from heavy water reactor 101 (putting into operation in 1958) is transported to interim storage by tank trailer; Intermediate-level radioactive liquid waste in swimming pool reactor 49-2 (putting into operation in 1964) has not been transported outside since its operation and has been stored in the facilities. Intermediate-level radioactive liquid waste in radioactive laboratory is transported by underground pipeline. Original transportation system of radioactive liquid waste is composed of about 1277 m long transportation pipeline, intermediate-level liquid waste transfer station and interim storage. There was not cement solidified waste facility before for processing intermediate-level radioactive liquid waste and all the intermediate-level radioactive liquid waste for R & D is put into interim storage. The pipeline of intermediate-level radioactive liquid waste in CIAE was put into operation in 1965 and shut down in 1994.
- Planning transportation system of intermediate-level radioactive liquid waste consists of transportation system with tank (tank, collection workshop, storage of vehicle and decontamination workshop), interim storage and multi-function treatment workshop. The multi-function treatment workshop for treating intermediate-level radioactive liquid waste with cement solidified waste has been completed. The transportation system and interim storage for intermediate-level radioactive liquid waste from scientific research activities in future are in the feasibility phase. Transportation mode of intermediate-level radioactive waste is to select: tank transportation, or most using tank and a little using pipeline! The key point for the construction of this new system is how to select shipment container and vehicle correctly? The new transportation system of intermediate-level radioactive liquid waste will be completed at the beginning of 2007.

2. Transportation of spent fuel outside

- Current storage of spent fuel: since swimming pool reactor 49-2 was put into operation, spent fuels have been always stored in the pool. Storage pool for heavy water reactor 101 is not enough: designed for 297 but 302 spent fuel assemblies have been stored until this year.
- Parameter of spent fuel assembly: swimming pool reactor 49-2 is composed of assembly rods, upper lattice, lower lattice, assembly housing, crane and the front end. Core is made of UO₂-Mg dispersion and all the other parts are made of Al-alloy. Size of assembly housing is 68 × 68 × 766 mm. Assembly rods are arranged 4×4 and the distance between rods is 16 mm. Spent fuel assemblies in reactor 101 are rod bundle type, which are composed of assembly rods, fixed lattices, throttle pipes, retaining frames and fixed nuts.
- Shipment container: spent fuel transportation container of RY-IB type is used in swimming pool reactor 49-2, RY-IA type is used in reactor 101. They are all coming from RY-I and only basket for crane is replaced. The structure design and materials are not big changed compared with old type.
- Method of transportation outside: transport by road with truck.

- Planning transportation: for heavy water reactor 101, 96 spent fuel assemblies are transported outside in 2004, 180 in 2006, all spent fuel assemblies (estimated 265 spent fuel assemblies) from 2008 to 2015; For swimming pool reactor 49-2, 56 spent fuel assemblies are transported outside in 2004, 120 spent fuel assemblies in 2006, 200 ~ 210 spent fuel assemblies from 2011 to 2018.

3. Transportation of NPP spent fuel and fresh reactor fuel

- There are some physical and material check equipments and facilities are to be performed at CIAE. Those spent fuels will be transported with the transport package (Type R-52) which were purchased by CIAE from NCS in 2003.
- The fresh fuels for a new reactor (China Advanced Research Reactor - CARR) which are still under construction and will be put into operation by the end of 2006 will be transported with the transport package (Type MTR-D) which were also purchased by CIAE from NCS in 2004.
- CIAE is currently under investigation with foreign companies including NCS for the possibilities of the transport package containing medium level liquid waste inside of the institute.

CIAE is a multi-disciplinary and comprehensive nuclear scientific research bases, a lot of pioneering work has been carried out and world-level results of scientific research have been achieved in fundamental and application researches. Its major tasks are: Basic research of nuclear science and technology, R&D of advanced nuclear energy and application of nuclear technology. There are wide range of potential cooperation with different international organizations, institutes, companies etc and there will be more cooperation in the future.